Tech. Memo:
Portland Harbor Superfund Site
NOAA integration of Lines of Evidence for Benthic Risk
Date: 03/22/2007

Objective:
NOAA has created a scaled and spatially explicit framework for evaluating risk to benthic invertebrates in the Portland Harbor Superfund site based on sediment bioassay testing and 2 predictive models. NOAA is integrating the *Floating Percentile Model (FPM)*, the *Logistic Regression Model (LRM)* and *sediment bioassay data (Hyalella azteca & Chironomus tentans)* in a spatial framework to identify potential areas that may pose risk to benthic organisms and provide a context to identify data gaps within Round 3B and the RI/FS process.

NOAA has created a gridded cell representation of the Lower Willamette River from river mile 1 to 11, which captures the Initial Study Area (ISA) and a portion upstream and downstream. This representation of the river uses a +13 NAVD88 shoreline (source: LWG Comp. Rd. 2 Data Report) and integrates data at a spatially meaningful scale. The grid cells are roughly 0.4 acres each and are intended to provide fairly uniform building blocks to evaluate:

- The presence of data
- The absence of data
- Multiple indicators/measurements of risk to benthic organisms

The 2 predictive models (FPM & LRM) have been scaled to represent the potential for toxicity based on the surface sediment chemistry suite analyzed at a station location. More information on the calculation and interpretation of the LRM can be found in several documents including [a]Field et al 2002 and the [b]LWG Benthic Interpretive Report ; more information on the FPM can be found in the Benthic Interpretive Report (Windward 2006).

The Logistic Regression Model calculates a probability of toxicity- Pr_{max} based on the surface sediment chemistry. The Floating Percentile Model essentially develops SQV's for a selected set of chemicals based on the floating percentiles intended to minimize false positives and negatives.

Methods:
The predictive models and the sediment bioassay data have been scaled based on the following criteria:

Logistic Regression Model

Logistic Regression Model	prmax<0.4	prmax>=0.4 and prmax<0.61[a]	prmax>=0.4 and prmax<0.61 and count gt40>1	prmax>=0.61	if count PrMax > .61 > 1[b]
LRM	0	1	2	3	+1 to score

[a] Field et al, 2002. Predicting Amphipod Toxicity from Sediment Chemistry Using Logistic Regression Models. *Envir.Toxicol. Chem. 21:1993-2005.*
[b] Windward et al, 2006. PORTLAND HARBOR SUPERFUND SITE ECOLOGICAL RISK ASSESSMENT: Interpretive Report: Estimating Risk To Benthic Organisms Using Predictive Models Based On Sediment Toxicity Tests. Draft March 17, 2006. Accessed LWG Portal.

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Floating Percentile Model

Floating Percentile Model	q80max<1	q80max>=1 and q70max<1	q70max>=1 and q80max >=1	if count q80max > 1[c]
FPM	0	2	3	+1 to score

For the sediment bioassay data, the control-adjusted response for growth & survival has been scaled based on the following criteria:

Sediment Bioassay	Effects Level 0	Effects Level 1	Effects Level 2	Effects Level3
HY28 [d]	0	1	2	3
CH10 [d]	0	1	2	3
ctrl-adj. response	> 90%	80-90%	70-80%	< 70%

Notes on scaling methodology

a For LRM, if more than one analyte per station has .41 < PrMax < .61 but # chemicals > .41 is > 1 then +1 is added to the score

b For LRM, if more than one analyte per station has a PrMax > .61 then +1 is added to the score

c For FPM, if more than one analyte per station has a q80>1 then +1 is added to the score

d HY28 & CH10 are for control adjusted response (Growth and Survival endpoints)- the most severe response for either test/endpoint was used

The highest score from these 3 indicators of benthic risk were summarized based on the grid cell that contains the station(s) location. The maximum score for each line of evidence was used for cases where multiple samples were in the same grid cell. These lines of evidence are represented as shaded grid cells with the following designation of potential benthic risk:

Score	Potential Benthic Risk
No Data	**No Data**
0	**Not Likely**
1	**Low**
2	**Medium**
3	**High**
4	**Very High**

Mapping:
The **1st map series** contains spatial data layers representing surface sediment bioassay data, predictive models summarized by grid cells, LWG iAOPC's identified as benthic risk and base spatial data layers.

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The **2nd map series** contains spatial data layers representing the potential benthic risk lines of evidence summarized by grid cells, surface sediment bioassay data, all station locations containing surface sediment used in the predictive models, LWG iAOPC's identified as benthic risk and base spatial data layers.

The **3rd** map series aggregates grid cells into areas of potential concern based on the presence of grid cells scored as high risk. These Areas Of Potential Concern can be further refined to establish data gaps and support decision making. Additionally, all input data from the lines of evidence is captured in this spatially based grid cell approach which can facilitate detailed summary and investigation.